Scheduling Run-6

- *"I may not have gone where I intended to go, but I think I have ended up where I needed to be." (Douglas Adams)*

Scheduling Run-6

"You live and learn. At any rate, you live"
&
"Flying is learning how to throw yourself at the ground and miss." (DA)

Scheduling Dynamics: Kin Yip

Machine vs Expt. :

Total physics processes of interest in an expt.

$$Nexp = \int (\varepsilon \bullet \sigma \bullet L) \, dt$$

Machine $\Rightarrow$ maximize $\int L \, dt$ $(L(t))$

Expts. $\Rightarrow$ maximize Nexp $(\varepsilon(t) \bullet L(t))$

dead channels, degraded detector performance etc. all reduce ε

Note: for pp $Nexp = \int (\varepsilon \bullet \sigma \bullet L \bullet P) \, dt$

where $P = P^2$ or P^4

Scheduling Dynamics: Kevin

What is actually paid for is:

$N_T = N_{exp} + N_{missing} + N_{setup}$

$N_{missing} = N_{APEX} + N_{Maint} + N_{Fail} + N_{ExpAccess} + N_{Fill} + N_{Devel}$

$N_{setup} = N_{Initial} + N_{Rotators} + N_{Energy} + N_{Species}$

Benefit to $\varepsilon(t)$: $N_{Maint} + N_{ExpAccess}$

Benefit to $L(t)$: $N_{Devel} + N_{APEX} + N_{Maint}$

Exp. Overhead: $N_{Rotators} + N_{Energy} + N_{Species} + N_{Initial}$

Without any doubt is BAD: N_{Fail}

Would be nice if it was 0: N_{Fill}

Scheduling Dynamics: Kevin

Where do we lose most*?

	Hours	% w/o setup
Science	1066	39.7 %
Machine Setup	496	18.5 %
Machine Devel.	215	8.0 %
APEX	129	4.8 %
Exper. Setup	79	2.9 %
Unscheduled Downtime	441	16.4 %
Unscheduled Shutdown	100	3.7 %
Maintenance	160	6.0 %

*Note: Sums of weekly numbers from 2/28 to 6/20.

Luminosity: standard approach

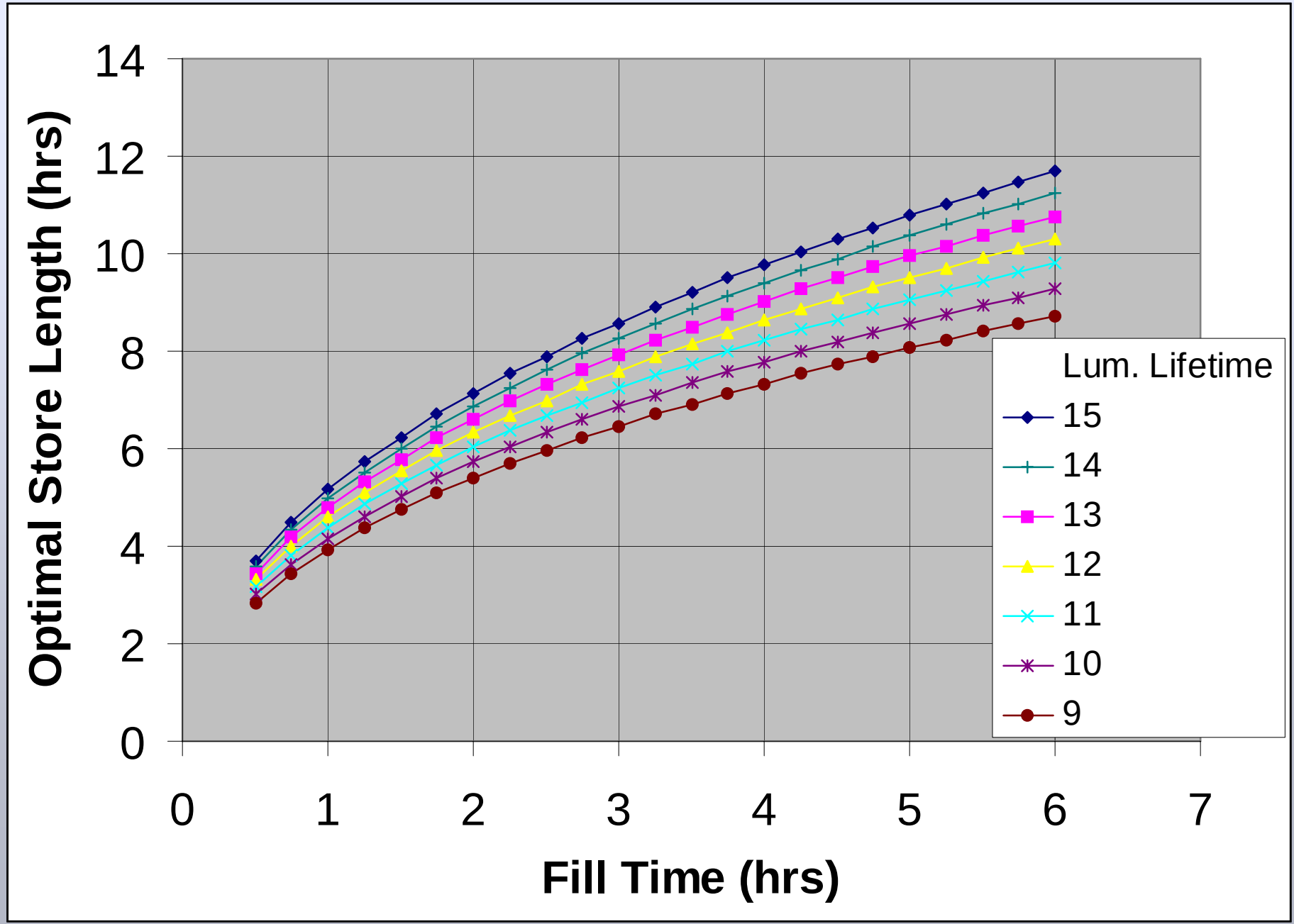
Luminosity decay, where τ is lifetime:

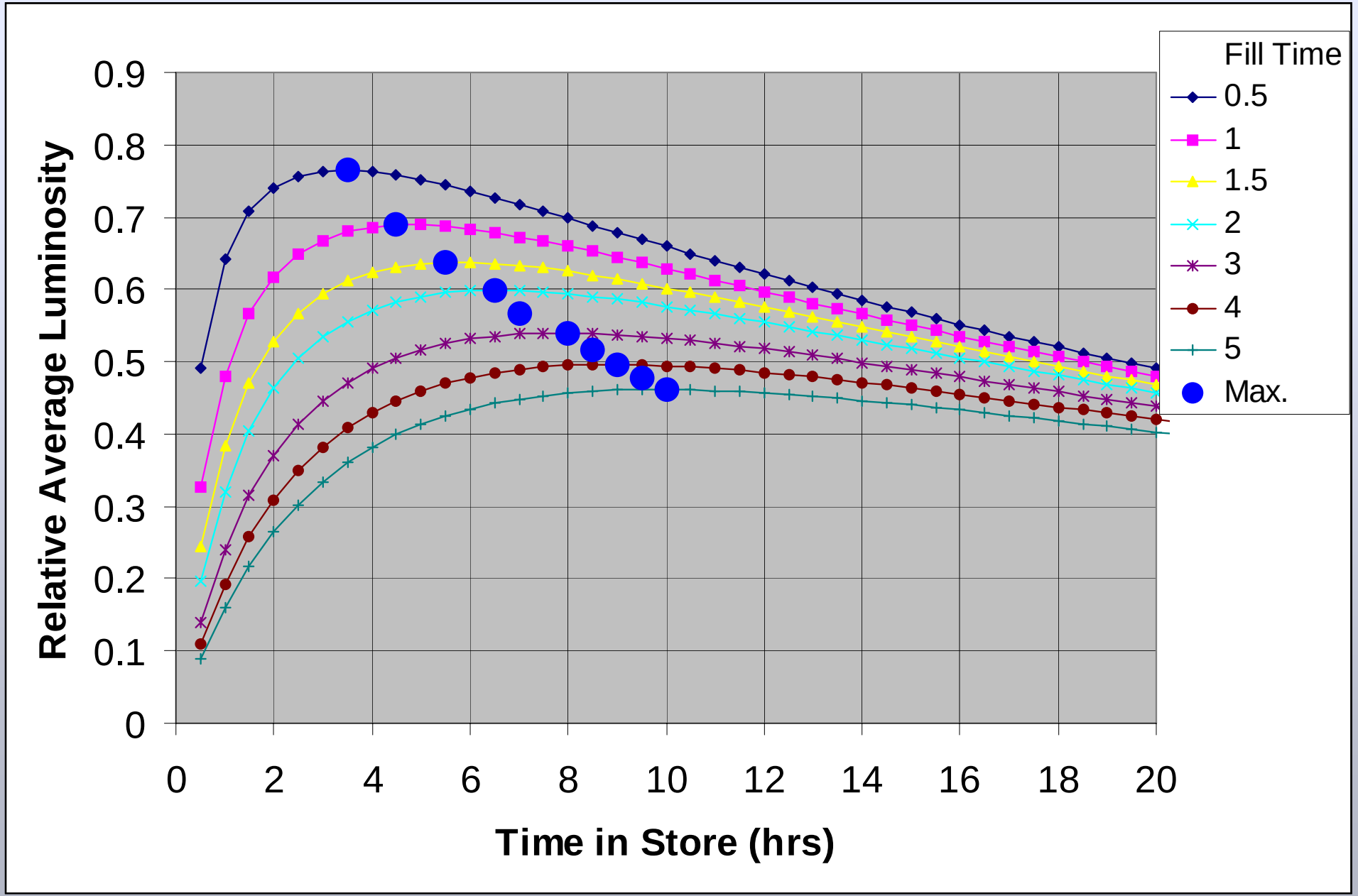
$$\mathbf{L} = \mathbf{L}_0 \, e^{-t/\tau}$$

Average Luminosity, with fill times t_f and beams in collisions times t_c is:

$$\langle \mathbf{L} \rangle = \mathbf{L}_0 \, \tau \left(1 - e^{-t_c/\tau}\right) \Big/ (t_c + t_f)$$

Solve for optimal integrated Luminosity.


Optimal Store Length (hrs)
14
12
10
8
6
4
2
0
0
1
2
3
4
5
6
7
Fill Time (hrs)
Lum. Lifetime
15
14
13
12
11
10
9


Relative Average Luminosity
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
12
14
16
18
20
Time in Store (hrs)
Fill Time
0.5
1
1.5
2
3
4
5
Max.

Functional Forms (FNAL)

- $\mathscr{L}(t) = \mathscr{L}_0 \, e^{-t/\tau}$
- Time-independent lifetime
  - Two parameters: τ and $\mathscr{L}_0$
    - *One fit restricted to 1st 2 hours, one is not*
- Time-dependent lifetime $\tau(t)$ choices
  - One parameter $\tau(t)$ fit, 2 parameters in all
    - $\tau = \tau(t) = C\,t$
  - Two parameter $\tau(t)$ fit (3)
    - $\tau(t) = \tau_0$, $t < 2$ *hours*
    - $\tau(t) = \tau_\infty$, $t \geq 2$ *hours*
  - Two parameter $\tau(t)$ fit (3)
    - *(from McGinnis)*
    - $\tau(\infty)$ *fixed*
  - Three parameter $\tau(t)$ fit (4)
    - *Used in the Operations Model*
    - $\tau(t) = \tau_0 + C_1\, t^{\,C_2}$

$$\tau(t) = \tau_\infty \left(1 - \left(1 - \frac{\tau_o}{\tau_\infty} \right) e^{-\frac{t}{\tau_\infty}} \right)$$

From Elliott McCrory presentation: Fitting the Luminosity Decay (2004)

http://beamdocs.fnal.gov/AD-public/DocDB/ShowDocument?docid=1091

Comments on Scheduling

- Meetings
- APEX Works
- Maintenance (3 weeks doesn't work)
- Experimental Accesses
- Run Coordinators

Meetings

- Too many meetings.
- 8:30 meeting is key during setup. Why keep it for the entire run?
- Polarized 4 pm meeting : Too Long!
- Others (+ 9 – 10 meetings/wk)
  - ✓ Injectors = can't be missed; key
  - ✓ Exp. Support = key, good example
  - ✓ RHIC = rarely useful: too many presentations
  - ✓ Mon. Scheduling meeting: extremely important for Weekly issues
  - ✓ Tue. Scheduling meeting: extremely important for long term issues.

APEX

- APEX works.
  - ✓ Here is one thing that sticks to schedule.
  - ✓ Showed great flexibility.
  - ✓ Recovery is not a problem.
- Comments on APEX (Kevin's perception)
  - ✓ There should be open proposal presentations with local peer review (positive feedback).
  - ✓ On the other hand, learning comes from experience (and experiments).
  - ✓ Give Yun a prize. He is a good example!
  - ✓ APEX sessions are too long!

APEX

- My Proposal: Shorter, more frequent APEX
  - ✓ 2 hours every day of the week (long lunch time studies) + 4 hours every Wednesday OR
  - ✓ 3 sessions/week, variable length depending on experiment requirements. Monday, Wednesday, & Thursday.
- APEX policy needs clarifying.
  - ✓ What is policy during a setup week? (e.g., during 22 GeV and 62.4 GeV week)
  - ✓ Current policy says 12 hrs/wk AT MOST. When did we every do less? (except to cancel)
  - ✓ When does APEX become experiment contingency?

Maintenance

- Maintenance is not a problem, recovery from maintenance is a problem.
  - ✓ Making fewer maintenances avoids the real problem.
- Proposals
  - ✓ One maintenance every week (a short one) + one long maintenance/month.
  - ✓ Or go back to every two weeks.

Experimental Accesses

- Emergency access cannot be avoided.
- More frequent maintenance will help.
- Most of the time they can be scheduled behind something else, so the real impact doesn't look that bad.
- Non-emergency accesses are disruptive.

Run Coordinators

1. We need the LP's back.
   1. Experiment run coordinators are doing too much. Not very effective, in my opinion.
   2. They need to focus on the experiment and allow the detail interface with CAD to go to a CAD representative.
2. Need a schedule or list of experimental improvements.
3. Experiments need a test beam. Too many improvements are going in during physics running. IF we had a test beam, we all know they would use it!

What is a Liaison Physicist?

- Responsible for all interfaces between experiment and C-AD.
- Assists in beam definition for experiment (e.g., what Angelika does now).
- Handles Radiation safety issues (shielding, radiation monitors, RSC reviews, …).
- Handles experimental safety issues.
- Becomes the experiment advocate within the department.
- Assists in run planning and execution.
- + much more…

Final Remarks

- More effort needs to go into improving (reducing) time between stores.
- Experimenters are not pushing hard enough to get optimal store conditions (time between stores & optimal store lengths).
- I have learned a lot about RHIC (& some things perhaps I didn't want to know).
- Looking forward to next time ;-)